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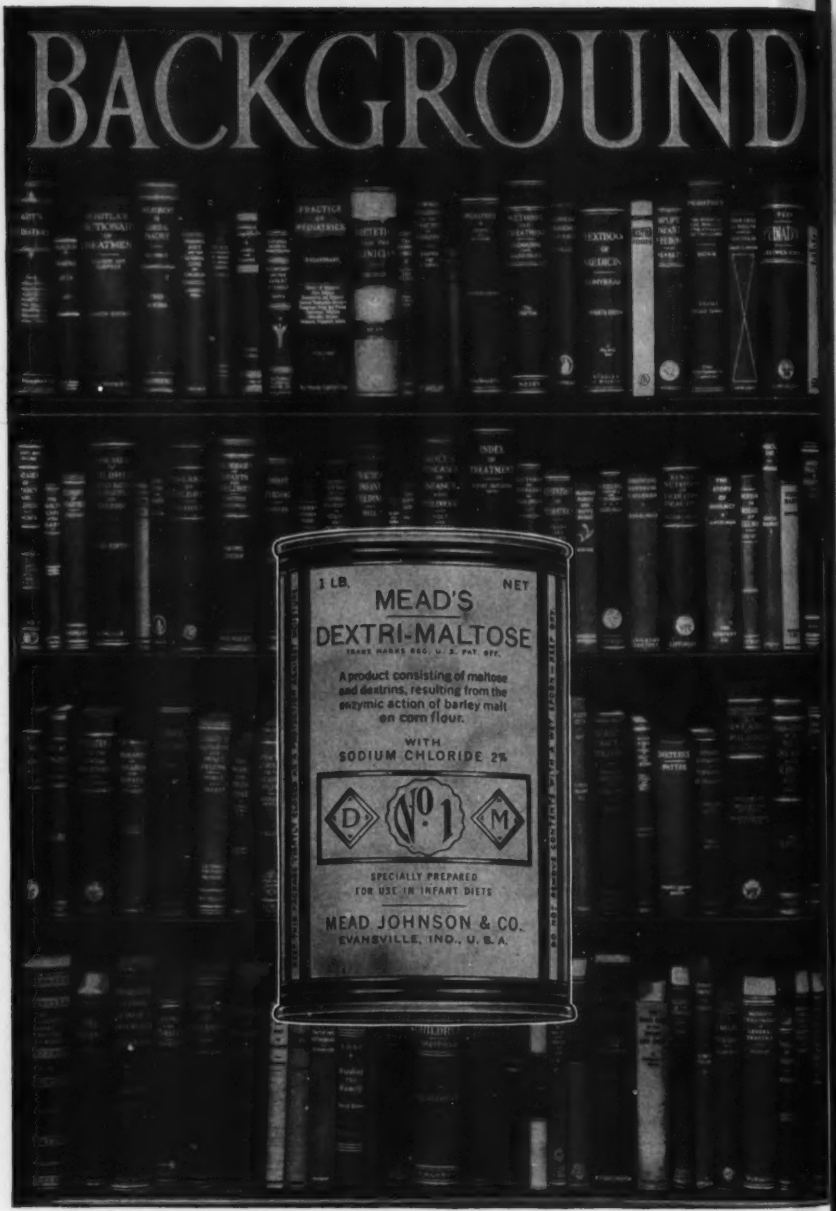
BACKGROUND



THE use of cow's milk, water and carbohydrate mixtures represents the one system of infant feeding that consistently, for over three decades, has received universal pediatric recognition. No carbohydrate employed in this system of infant feeding enjoys so rich and enduring a background of authoritative clinical experience as Mead's Dextri-Maltose.

INGESTION OF POISONS IN CHILDREN: A SURVEY OF 250 ADMISSIONS TO CHILDREN'S HOSPITAL

Special Report

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Few accidents in everyday life cause more consternation and anxiety than the ingestion of poisonous substances by our ever curious children. Fortunately, the majority of these incidents end happily with a minimum of discomfort to child and parent. An appreciable number, however, end in tragedy.

Accidental poisoning in children is responsible for over 500 deaths yearly in the United States. In addition, it comprises about one per cent of pediatric hospital admissions.

The purpose of this study is to review 250 consecutive admissions for acute ingestion of poisons to the Children's Hospital from July 1944 to September 1948. This number represents 1.07 per cent of the total number of admissions during this period. There were two deaths, one attributed to phosphorus, the other to methyl salicylate. The mortality rate was 0.8 per cent.

Sixty-one different poisonous substances were ingested by our 250 children. Among these patients were 88 colored males, 61 colored females, 55 white males, and 46 white females. The higher incidence in the colored race is more striking when it is remembered that the total number of white patients admitted to this hospital outnumbers the colored by a two to one ratio. The ages varied from 1 week to 12 years with an average of 26 months.

Kerosene was by far the most frequently ingested poison (Fig. 1). There were 54 cases, 21 percent of the total number. The next ten most common poisons in order of their frequency were barbiturates, lye, camphor, turpentine, clorox, cleaning fluids, alcohols, phenols, salicylates and fluoride, followed by rat poisons, insecticides, belladonna, thyroid extract, boric acid, sulfadiazine, mercury, furniture polish and baby powder. In most cases the quantity of substance ingested was either not known or not reported.

Kerosene:

Fifty-four patients ingested kerosene (Fig. 2). Simple kerosene was ingested 50 times. In two cases it was associated with DDT in insecticides

and in two others it was one of the ingredients of furniture polish. Forty-eight patients (89 per cent) were colored, a consequence of the use of kerosene as "fuel oil" in the kitchen of lower income households. The average child was 19.7 months old and stayed in the hospital 6.4 days. Gastric lavage was done 48 times, 89 per cent of the total. Twenty-six patients received sulfadiazine or penicillin to prevent or treat an associated pneumo-

Kerosene	54	Rat poisons	7
Barbiturates	18	Insecticides	7
Lye	14	Belladonna	6
Camphor	14	Thyroid extract	6
Turpentine	11	Boric acid	5
Clorox	10	Sulfadiazine	5
Cleaning fluids	10	Mercury	3
Salicylates	9	Furniture polish	3
Alcohols	9	Baby powders	3
Phenols	9	Miscellaneous	44
Fluorides	8		
		Total	255*

FIG. 1. Distribution of Poisonous Agents Among 250 Cases

(*Five patients ingested two poisons each)

Number of Patients	54
CM 27 WM 3	
CF 21 WF 3	
Average age	19.7 mos.
Hospital stay	6.4 days
Gastric lavage	48 (89%)
Chemotherapy	26 (48.2%)
Pneumonia:	
By x-ray	22 (40.8%)
Bilateral	16 (73%)
Unilateral	6 (27%)
Probable	4 (7.4%)

FIG. 2. Analysis of 54 Cases of Accidental Kerosene Ingestion

nia. These drugs had no appreciable prophylactic or therapeutic effect. Bronchopneumonia, the only serious complication, was demonstrated by x-ray in 22 cases (40.8 per cent) and probably occurred in four others in which x-rays were not taken. Thus it may be said that nearly half of the patients developed pneumonia. This pneumonia was bilateral in 16 cases (73 per cent) and unilateral in six (27 per cent). A rather uniform sequence of symptoms and signs occurred. Immediately after swallowing kerosene the child vomited, gagged, choked, and coughed. The coughing persisted several minutes and then deep drowsiness ensued. The child was brought

to the dispensary, lavaged, and sometimes given a stimulant. By the time he reached the ward he was alert and disclosed no abnormal physical findings except the odor of kerosene. Half of the cases remained afebrile and made an uneventful recovery. Within 24 to 36 hours the other half developed fever of 102 to 104 degrees and rapid, labored respirations. Although the physical chest signs were few or absent, moderate or extensive bronchopneumonia was demonstrated by x-ray in one, or more often in both, lungs. All the patients were discharged in apparently good condition. There was no evidence of damage to the heart, liver, and kidneys, but investigations of the status of these organs were seldom made.

The mechanism for the production of pneumonia following ingestion of kerosene has been the subject of considerable speculation and a few experimental investigations. It is generally accepted that direct aspiration of kerosene fumes is the chief cause of chemical pneumonitis. However, the role of absorbed kerosene in the blood stream in the production of pulmonary changes is not so clear, and the results of experimental studies have been conflicting.

In 1943, Lesser, Weens, and McKey[10] administered kerosene to rabbits by stomach tube and found no pulmonary changes, while direct intratracheal instillation invariably produced pneumonia. The following year, however, Deichman and his associates[3] administered kerosene to rabbits intravenously, intraperitoneally, and orally, and found pulmonary lesions, attributed primarily to vascular injury, in all cases. They concluded that "pulmonary injury may be sustained from the kerosene carried to the lung by way of the blood stream as well as from the direct introduction of the fluid into the lungs by aspiration" and recommended that every effort be made to remove the kerosene in order to avoid systemic effects.

In 1947, Steiner[19] analyzed 35 cases of accidental kerosene poisoning and divided them into three categories on the basis of severity. The majority of patients (26) were in the first group, characterized by acute toxicity, minimal pulmonary changes and rapid recovery. Six patients with severe pneumonia and prolonged recovery were in the second group and four with severe pneumonia and toxic changes in the liver, kidneys, spleen and myocardium (manifested by extensive pneumonia and cardiac dilatation by x-ray, hepatosplenomegaly, and urine albumin, cells and casts) were in the third group. All recovered.

The initial treatment of kerosene ingestion should consist of cautious lavage of the stomach with large quantities of warm water or weak sodium bicarbonate solution, leaving 30–60 cc. of olive or mineral oil. A special effort to avoid gagging or regurgitation should be made and emetics never used because of the dangers of aspiration. Chemotherapy may be used, but we are inclined to believe that it is ineffectual in the prevention or treat-

ment of pneumonia. Frequent evaluations of the status of the heart, lungs, liver and kidneys by physical examination, x-ray and laboratory studies are recommended.

Barbiturates:

The barbiturates ran a poor second to kerosene and accounted for 18 cases or 7.2 per cent of the total number. Phenobarbital was the offender in nearly all the cases. White children outnumbered the colored by a five to one ratio. One of the white children, a 12 year old girl, attempted suicide. The most common manifestations were coma, semi-coma, or drowsiness with slow deep respirations and constricted, sluggish pupils in nearly one-half of the cases. (Dilated, sluggish pupils indicate severe poisoning.) Since all cases responded promptly to a variety of central nervous system stimulants (most frequently caffeine sodium benzoate) it is suspected that the amount of these drugs ingested was not unduly large.

Treatment of barbiturate poisoning is carried out with a purpose of removing the drug that remains in the stomach and counteracting the central nervous system depression caused by the drug absorbed. Lavage with warm water or 1:2000 potassium permanganate may be augmented by leaving in magnesium sulfate for catharsis. Various respiratory stimulants such as caffeine sodium benzoate, coramine, ephedrine, metrazol, strychnine, or picro-toxin may be given. Black coffee enemas are helpful in less severe cases. Picrotoxin is the drug of choice for deeply depressed patients and is given intravenously as a 1:1000 solution in physiological saline at the rate of 1 mg. per minute until the corneal reflexes or some sign of motor activity appear. (This dose may be too high for small children.) Parenteral glucose and saline solutions are recommended to accelerate excretion and assist the liver in its detoxification mechanisms.

Lye:

Lye was the third in frequency among the poisonous agents and accounted for 14 admissions or 5.6 per cent of the total. Eight were colored and six white. The average patient was 21.7 months old and remained in the hospital only 5.8 days. Thirteen children had burns of the lips or mouth and six of these had rather extensive burns of the posterior pharynx and tonsils. *Yet, not a single instance of esophageal stricture was reported in these 14 cases.* Although the follow-ups were meager or absent, it is probable that at least a few of the patients would have returned if they had developed symptoms of stricture. Barium "swallows" were done in only two patients with one showing a narrowing of the distal esophagus. However, the patient remained asymptomatic and nothing was done. No dilatations were attempted in these cases. Bilateral bronchopneumonia occurred in one patient.

Lye poisoning occurs as a result of accidental ingestion of commercial lye preparations (95 per cent sodium hydroxide) or cleaning powders (8 to 50 per cent sodium hydroxide). It is primarily an affliction of the poorer classes and in some parts of the country ranks first among accidental poisonings in children. The ingestion of homemade soap containing lye is a common cause of these accidents and accounted for one of our cases.

Lye is the most frequent cause of esophageal stricture in children. Although strictures were not evident in our cases, a fact we are at a loss to explain, we are in agreement that their prevention should be of primary concern in the plan of treatment.

Gellis and Holt in 1942[4] reported a study of 55 acute cases of lye ingestion. Forty-one of these were treated according to the Salzer method of prophylactic dilatation, while 14 were treated symptomatically. In the former group there was only one stricture, a percentage of 2.5, while in the untreated group there were six strictures or 43 per cent. One death occurred shortly after ingestion of lye in a case in which dilatation had not been attempted. These authors also reported 39 cases seen after strictures had developed. There were eight deaths in this group (four from rupture of the esophagus following esophagoscopy, one resulting from esophagotracheal fistula, one of pneumonia, one of peritonitis following gastrostomy, and one suddenly after gastrostomy).

Treatment of the acute cases consisted of (1) neutralization with a weak acid such as vinegar or lemon juice, (2) application of emollients to visible burns, (3) early and continued dilatations of the esophagus. Graduated shot-filled catheters were passed within the first few days and daily with a gradual increase in size. The interval between dilatations was increased after two weeks, but they were continued for months and years.

Gastric lavage is unnecessary, because very little lye is likely to reach the stomach and that organ's acid secretion acts as an excellent antidote.

Camphor:

Camphor was the toxic ingredient responsible for 14 cases of acute poisoning. These included camphor oil (10), Sloan's Liniment (3) and Vick's salve (1). In most of these cases the accident was on the part of the parent rather than the child. On several occasions camphor oil was given when castor oil or cod liver oil was intended. One mother was advised by her physician to give her child an "oil enema" and did so, using camphor oil.

The symptoms of camphor poisoning are those of central nervous system stimulation. The majority of our patients exhibited little more than vomiting but convulsions occurred in five cases and cyanosis in three. All made rapid recoveries with a minimum of sedation. Death from camphor ingestion is rare and occurs from respiratory failure. Mothballs formerly contained camphor but now are composed of naphthalene.

Treatment consists of gastric lavage with warm water, 1:1000 potassium permanganate or tea. *Oils and alcohol should be avoided because they render camphor more soluble and absorbable.* Short-acting barbiturates should be employed, perhaps even before lavage, in patients who are convulsing.

Turpentine:

Turpentine is a volatile oil that is readily accessible from its use in paints and varnishes. It is readily absorbed from the skin, gastro-intestinal tract, and lungs and causes central nervous system stimulation (later coma) and symptoms of renal damage. Death is rare but fatalities in children have been reported following the ingestion of 12–15 cc.

Eleven cases of turpentine ingestion were recorded. Coma or drowsiness were present in six patients, and fever and vomiting in four. One patient developed pneumonia. All were discharged in apparently good condition.

The offending material should be removed from the stomach by lavage and symptomatic treatment instituted.

Clorox:

Clorox, a cleansing and bleaching agent containing 5.2 per cent sodium hypochlorite, was ingested by ten of our children, all colored. Seven vomited and four had corrosive burns involving the chin, lips, tongue, and pharynx. Aphonia, presumably from laryngeal edema, occurred in one child and lasted five days.

Bleaching solutions exert a toxic effect by the liberation of chlorine from hypochlorites with resultant corrosion, when ingested, of the mouth, pharynx, esophagus, and gastro-intestinal tract. Esophageal strictures may occur but were absent in our cases.

Treatment of clorox ingestion should consist of emollients to the accessible burns and lavage with copious amounts of warm water.

Cleaning Fluids:

Ten patients ingested assorted cleaning fluids four of which were said to contain benzine. Vomiting, coughing, and drowsiness were the most common symptoms and two children developed bronchopneumonia. All recovered.

Benzine, benzol, and carbon tetrachloride are the most common ingredients of cleaning fluids. Benzine resembles kerosene in composition and mode of action. Benzol is a coal tar distillate which first causes excitement and then depression and sometimes death from respiratory paralysis. Carbon tetrachloride is a central nervous system depressant and may cause severe toxic degeneration of the heart and liver.

Treatment of benzine and benzol consists of lavage and supportive measures.

Administration of calcium salts and institution of a liver protective (high protein, high carbohydrate) diet are additional precautions recommended for the ingestion of carbon tetrachloride.

Salicylates:

Salicylate intoxication was recorded nine times in the cases studied. Five children ingested aspirin (acetyl salicylic acid) and recovered promptly with a minimum of toxic manifestations. Four ingested oil of wintergreen liniment (methyl salicylate), and only three recovered after protracted stormy courses. All four patients exhibited vomiting, fever, hyperpnea, tachycardia, and a reduced carbon dioxide combining power. One of these was admitted in a state of collapse and in convulsions and expired two hours after admission to the hospital and 22 hours after ingestion of "wintergreen liniment." Necropsy disclosed dilatation of the heart, congestion of the lungs, liver, and kidneys, and generalized lymphatic hyperplasia.

While aspirin overdosage seldom causes severe poisoning, methyl salicylate is notorious for its deleterious effects and high mortality rate. This discrepancy is explained by a greater degree of retention of methyl salicylate in the body.

The mechanism of salicylate intoxication has been the subject of a great deal of study and controversy. Current opinion favors the following sequence of events:

(1) The salicyl radical stimulates the respiratory center directly causing an initial hyperventilation which produces

(2) an uncompensated respiratory alkalosis.

(3) A marked ketosis, perhaps due to a disturbed carbohydrate metabolism, soon follows, a true metabolic acidosis occurs, and consequently the hyperventilation is resumed.

The CO_2 combining-power and pH of the blood should be determined. Avoid giving alkali to a patient with respiratory alkalosis. Nausea, vomiting, dizziness, tinnitus, mental confusion, and hypoprothrombinemia are other manifestations of salicylate poisoning.

Treatment is directed to remove the remaining drug by gastric lavage and to restore the altered acid-base balance. Physiological saline should be given to restore hydration in the early stages and M/6 sodium lactate to combat the ketosis of true acidosis later. Ample amounts of dextrose given intravenously aid in correcting ketosis.

Alcohols:

Nine of our 250 children arrived at the hospital in a state of acute alcoholism. They chose a wide variety of products, including whiskey, wine, cologne water, rubbing alcohol, and antifreeze. Seven of the products con-

tained ethyl alcohol, one methyl alcohol, and one contained both. Two patients were in shock, but all recovered uneventfully.

The manifestations of acute ethyl alcoholism are well known and require no elaboration. Central nervous system stimulants parenterally or black coffee enemas are indicated.

Methyl alcohol is extremely toxic. It is oxidized in the body to formaldehyde and formic acid with the ensuing acidosis resulting in cardiac depression, respiratory failure, and coma. Blindness is common if the patient recovers.

Treatment consists of gastric lavage, oxygen, respiratory stimulants, and the correction of acidosis.

Phenols:

Phenols and cresols accounted for nine cases of accidental poisoning with minimal toxicity and prompt recovery in all. Six of the children ingested lysol, a cleaning solution containing cresol.

Ingestion of these products corrodes the mucous membranes of the alimentary tract and when absorbed causes widespread vascular damage, shock, and death.

Treatment is directed to prevent absorption. Lavage with olive oil as a solvent is recommended. Alcohol, while beneficial when applied to the skin and buccal mucosa, facilitates absorption and should be kept out of the stomach.

Fluoride:

Sodium fluoride was the toxic agent present in eight cases of roach powder ingestion. The most frequent symptoms noted were severe vomiting and abdominal pain, drowsiness or semi-coma, and in two cases, convulsions. Hematemesis and depressed respirations are other symptoms which have been frequently reported. There were no deaths in our cases, but it should be kept in mind that fluoride poisoning is very lethal, and even small amounts (about one gram of sodium fluoride in children) may cause death within a few hours if prompt therapy is not instituted. When death occurs it is due either to respiratory paralysis or to cardiac failure.

The first thought in the treatment of fluoride poisoning is to convert the soluble and toxic sodium salt to insoluble and innocuous calcium fluoride. This is accomplished by immediate lavage of the stomach with calcium gluconate or calcium lactate, leaving in 30 cc of a 10% solution. A soluble calcium salt should also be given intravenously or intramuscularly.

Rat Poison:

Rat poisons were ingested seven times. Strychnine was the toxic ingredient in four cases, arsenic and phosphorus each accounted for one, and the

contents of the seventh were not known. The patients who ingested strychnine and arsenic showed no evidence whatever of toxicity, and the child who ate the undetermined agent had only one symptom, vomiting. However, a two year old colored boy who ingested a phosphorus-containing rat poison died two hours later. His symptoms and signs consisted of severe hematemesis, abdominal pain, bradycardia, irregular respirations, garlic odor to the breath, hepatosplenomegaly, and lastly, coma. Necropsy revealed dilatation of the right heart, pulmonary congestion and edema, and congestion of the viscera.

Strychnine poisoning formerly accounted for 200 or more deaths yearly among children. Although it is now less available, it still ranks as the number one cause of death in children due to poisoning. Strychnine is a powerful central nervous system stimulant and produces convulsions similar to tetanus. Treatment consists of intravenous barbiturates to control the convulsions, and then lavage of the stomach with potassium permanganate. Activated charcoal absorbs strychnine and should be placed in the stomach.

Arsenic is a general protoplasmic poison which apparently acts by reacting with sulfhydryl (SH) groups in enzymes necessary for cellular oxidation. Symptoms of intoxication appear rapidly and consist of severe vomiting, watery and bloody diarrhea, abdominal pain, constriction of the throat, muscle cramps, oliguria, shock, coma, and death.

Gastric lavage, cathartics, and parenteral fluids are administered. BAL is now a powerful adjunct to treatment. This is a sulfhydryl compound with an affinity for arsenic which removes the toxic ion from combination with the sulfhydryl groups of enzymes. BAL should be given as soon as possible and continued until arsenic is nearly absent from the urine.

Phosphorus may be ingested by its presence in rat poisons or certain firecrackers. Matches no longer contain the dangerous yellow phosphorus. Phosphorus is toxic to glands and muscles, and particularly to the heart and liver. Symptoms of poisoning consist of protracted emesis of a blood-streaked, garlic-scented vomitus, diarrhea, and abdominal tenderness in the region of the liver. The liver undergoes degeneration and produces jaundice, pruritis, and a disturbed carbohydrate metabolism. Hemorrhagic manifestations are due to an altered clotting mechanism and capillary damage. Oliguria reflects kidney damage. Cardiovascular collapse, delirium, and coma terminate in death.

Treatment is directed to remove the remaining drug or convert it to innocuous phosphoric acid. This is accomplished by lavage with 1:5,000 potassium permanganate. *Oily or fatty materials such as milk promote absorption of phosphorus and should be avoided.* Parenteral fluids are given as indicated for acidosis.

Insecticides:

Eight insect sprays were ingested. Two contained kerosene and DDT. The ingredients of the other six cases are not known. Insecticides, however, usually contain variable amounts of DDT, pyrethrum, and kerosene. (Modern insecticides may contain parasympathetic stimulants of the phosphate-ester type.)

DDT poisoning may cause vomiting, severe prostration, anoxia, and convulsions. Gastric lavage, intravenous calcium gluconate, atropine and barbiturate administration are indicated (atropine and central depressants counteract DDT convulsions).

Pyrethrum in large amounts causes cardiovascular collapse and death. Treatment consists of lavage and supportive measures.

Belladonna Group:

Six children, all white, ingested atropine solutions, berries of deadly nightshade, tincture of belladonna, and a stramonium-containing product. Flushing, dry skin and mucous membranes, dilated pupils and, in one case, convulsions and temporary blindness were recorded. Various degrees of mental disturbance were present in several of the children. Recovery was prompt with a minimum of treatment.

Children are particularly susceptible to these alkaloids but, fortunately, fatalities are rare.

The manifestations of atropine poisoning are well known and may be summarized by the following quotation:

"Hot as a hare
Blind as a bat
Dry as a bone
Red as a beet
And mad as a hen."[13]

Treatment consists of lavage with .04% tannic acid and administration of magnesium sulfate. Sedatives are used to control excess motor activity. The employment of pilocarpine or of other parasympathetic stimulants is unnecessary as the cause of death is not due to the *peripheral* action of the belladonna alkaloids.

Thyroid Extract:

Tablets of thyroid extract were ingested by six children. There were no toxic manifestations. Fortunately, large single doses of this drug rarely cause deleterious effects.

Boric Acid:

The youngest of our patients were a group of five infants ranging in age from one to ten weeks who were accidentally fed boric acid. Three *parents*

mistook boric acid powder for dextri-maltose and two, boric acid solutions for boiled water mixing it with orange juice. Four of these five infants had a minimum of toxic effect, but the fifth and youngest was seriously ill for four days. This one week old baby received approximately half a tablespoon (6–7 grams) of boric acid powder in his formula and vomited most of it immediately. On arrival at the hospital, however, he was critically ill, cyanotic, had a marked tachycardia and tachypnea, and a bright red skin. The carbon dioxide combining power was 30 volumes per cent and there was transient oliguria. He was treated with parenteral and oral alkaline solutions, improved after the fourth day, and was discharged on the ninth day.

Boric acid has long been recognized as a hazard in the hospital as well as the home, and several hospitals have removed it from use on their wards, usually because of tragic consequences. When ingested or absorbed from an injured skin surface as an ointment, boric acid produces fatty parenchymatous degeneration in the skin, muscles, and various organs. The most common manifestations are gastro-enteritis, hepatitis, degenerative nephritis, scarlitinal skin eruptions, visual disturbances, muscular debility, and vasomotor collapse. Treatment should consist of lavage, catharsis, and the administration of alkaline solutions if acidosis develops.

Sulfadiazine:

Sulfadiazine was given in overdosage or ingested accidentally in five cases. Hematuria in two were the only signs of toxicity. Recovery was prompt.

The effects of sulfonamide overdosage are well known. Renal damage is usually minimal and reversible. Large quantities of fluids and alkaline solutions are indicated.

Mercury:

Mercury was ingested three times with no symptoms other than vomiting and without evidence of toxicity. The products involved were 5% ammoniated mercury ointment, blue ointment of mercury (10%), both of which are insoluble salts, and mercurochrome, a relatively "benign" organic compound.

Bichloride of mercury, a soluble and highly toxic disinfectant, most commonly accounts for poisoning. The bivalent ion alone is toxic, acting as a marked protein precipitant. Following absorption, it is taken up by all tissues, but mostly by the kidneys, liver and spleen. Initial symptoms of vomiting, abdominal pain, and bloody diarrhea are due to gastro-intestinal irritation. Renal tubule dysfunction is the most prominent systemic manifestation and may cause death from oliguria and anuria.

As early as possible, protein for precipitation is provided by lavage with milk and eggs. Sodium formaldehyde sulfoxylate allegedly reduces the bivalent salt to the insoluble monovalent salt, and may be administered by lavage, colonic irrigation, and directly into the blood stream. "BAL", by its affinity for mercury, is being used with some success in early cases and should be employed in all cases as early as possible. Large quantities of parenteral fluids promote diuresis and excretion.

Furniture Polish:

Kerosene was present in two of five cases of furniture polish ingestion. The ingredients in the other three, two of whom developed bilateral bronchopneumonia, are not known. Besides kerosene, furniture polishes may contain linseed oil, oil of turpentine, cedar leaf oil, and carbon tetrachloride.

Baby Powder:

Two of the three baby powders ingested contained zinc stearate. Fortunately, all the babies recovered promptly with a minimum of difficulty. Zinc stearate may be aspirated by infants with tragic results. A severe irritation of the respiratory mucous membranes first causes signs of suffocation, and in a day or two of bronchopneumonia. Treatment by bronchoscopic aspiration is not very effective.

The remaining 44 children ingested 32 toxic or potentially-toxic agents which will merely be enumerated. There were two ingestions each of bromides, dexedrine, privine, lighter fluid, formaldehyde, phenophthalein, gentian violet, ammonia water, stilbestrol, codein, paregoric and DDT, and single instances of accidental ingestion of ammonium chloride, benadryl, carbazone, copper sulfate, dilantin, floor wax, hand lotion, ink, ipecac, nail polish, nitric acid, potassium permanganate, wall plaster, santonin, silver nitrate, shoe polish, tincture of iodine, wild mushroom, zephiran solution, and a wax crayon *whose ingestion was followed by methemoglobinemia.*

In analyzing these 250 cases of accidental poisoning, we were struck by the undue accessibility of toxic products in the households concerned. It seemed quite natural for the toddler to sample a coca cola bottle filled with kerosene in the kitchen, or a drinking glass containing lye in the bathroom. Rat and roach poisons were left in every convenient corner, and various and sundry medications were within easy reach on bedroom or dining room tables.

Every year pediatrics becomes more and more a preventive branch of medicine. In the office and clinic many hours are spent stressing the need for orange juice, cod liver oil, and a multitude of prophylactic inoculations. Public health workers are busy preaching the prevention of disease. Yet nary a word is said about kerosene and lye, liniments and pills, insecticides

and other poisons which sent 250 children to this hospital in four years, and which kill more than 500 of them in the United States every year.

We should like to add household-poison ingestions to the growing list of preventable diseases, and to urge every pediatrician to include a word of instruction about their prevention as one of his well-baby routines. As soon as the baby is walking and has a run of the house, his mother should be informed, preferably in writing, of the dangers of household powders, flakes and solutions, and of the importance of keeping these, as well as the usual galaxy of home remedies, out of sight and reach of small snoopers.

DISCUSSION

Theodore Koppanyi, Professor of Pharmacology and Materia Medica, Georgetown University School of Medicine:

Kerosene:

Kerosene, a petroleum distillate containing mixtures of saturated hydrocarbons ($C_{12}H_{26}$—$C_{15}H_{32}$) with a high boiling point (from 200° to 275° C.), was the most frequently ingested poison reported in a series of cases by Doctors Rubin, Recinos and Washington. Gasoline poisoning has also been frequently reported in children, but did not occur in the series of cases admitted to Children's Hospital. Kerosene poisoning occurs mainly in children of underprivileged homes and in rural communities where it is still used for illumination.

I should like to comment only on two phases of the above report. It ought to be emphasized that the symptoms of poisoning are variable, depending, I suppose, upon the types and proportions of the volatile products in this distillate. Kerosene is an irritant poison affecting the mouth, throat, stomach, kidneys and urinary bladder. It may also produce symptoms resembling the various stages of acute alcohol poisoning, the "jag" followed by drowsiness, respiratory and circulatory depression and coma (Price, 1932). I also should like to congratulate the staff at Children's Hospital upon the perfect record of their cases. In a series of 54 cases, there was no mortality, whereas in one of the most widely quoted reports on kerosene poisoning in children (Nunn and Martin, 1934) the mortality was 9.2 per cent. The only difference between the treatment employed by Doctors Nunn and Martin and that employed in Children's Hospital was that in the latter instance, sulfadiazine and/or penicillin was used for the possible prevention and treatment of bronchopneumonia so frequently encountered in this type of poisoning. Although Doctors Rubin et al. believe that this type of chemotherapy was wholly ineffectual, I am still wondering if the employment of these agents may not explain the absence of mortality.

Barbiturates:

The treatment of barbiturate poisoning in children requires constant nursing supervision. I agree that when a case of barbiturate poisoning readily responds to caffeine and sodium benzoate, to ephedrine, or to benzedrine, the amount of barbiturates ingested was not unduly large and the patients would have recovered without the employment of physiological antidotes. In serious cases of barbiturate poisoning, either metrazol or picrotoxin should be employed. The antidotal treatment should continue until the patient regains his reflexes and shows unmistakable signs of recovery. In children, 0.5 cc. of a 10 per cent solution of metrazol should be injected intravenously as an "orientation dose". The light cases will rally immediately and may stay awake without relapse after this initial dose. If this dose does not cause visible changes in the patient, it should be repeated every fifteen minutes, or picrotoxin treatment should be instituted (about 5 mg. every 30 minutes) accompanied by intravenous glucose infusion (Koppanyi et al.).

I must warn that many barbiturates are not oxidized by potassium permanganate and lavage is very often superfluous, because the poison may have been completely absorbed from the intestinal tract. It should be also pointed out that before metrazol or picrotoxin treatment is instituted one should obtain fool-proof histories, or still better, chemical evidence of the existence of barbiturate poisoning, because if the coma is not due to barbiturates or some other aliphatic depressant these antidotes will do more harm than good and may precipitate fatal convulsions. (Koppanyi et al., 1934; Hazleton and Koppanyi, 1941).

Lye:

Poisoning with corrosive alkalies is another instance where the stomach tube should not be passed owing to possible rupture of the injured walls of the esophagus and stomach. As little as 2 grams of lye have caused death. The fatal period may vary from 3 to 48 hours. There is nothing to add to the treatment of this type of poisoning as outlined by the authors except that the administration of opiates or methadon is imperative to alleviate pain.

Camphor and Oil of Turpentine:

These are volatile substances of similar pharmacological and toxic action. They produce their toxic effects first by stimulation (delirium, epileptiform convulsions) and later by depression (muscular incoordination, unconsciousness and coma) of the central nervous system. The characteristic odor on the breath usually establishes the diagnosis. Either of these substances may cause death within a day or two. The fatal dose in children for

camphor is about 1 gram, and for oil of turpentine from a teaspoonful to one ounce. The convulsions may be controlled by chloral, paraldehyde or barbiturates. Opiates should not be used. One may expect during the course of the poisoning the appearance of painful micturition, hematuria, albuminuria and oliguria.

Salicylates:

In children the ingestion of methyl salicylate is a frequent source of poisoning. Oil of wintergreen is said to be mistaken for candy. Stevenson (1937) reported 43 cases in children in which 59 per cent proved to be fatal. It is, therefore, not surprising that one of the patients admitted to Children's Hospital died of this poison. The odor of methyl salicylate may be discovered on the breath and vomitus and less readily in the urine. There is an air hunger present in this type of poisoning called "salicyl dyspnea". The increased respiration may produce a loss of CO_2 and urinary excretion of fixed base. This leads to respiratory alkalosis, which, particularly in cases of renal damage, may be followed by a marked ketosis. In spite of several reports, and the recommendations of our authors, I doubt if the carbon dioxide-combining power of the serum is appreciably changed in salicylate intoxication.

It may be well to remember that patients excreting salicylate show a false positive Benedict, and that the urine assumes a violet color following the addition of ferric chloride.

Death is said to have been caused in children by as little as one teaspoonful of oil of wintergreen.

Strychnine:

Doctors Rubin et al. rightly point out that in several hospitals strychnine still ranks as the main cause of death due to poisoning in children. In the present report, the cause of strychnine intoxication was ingestion of rat poisons, but the usual cause is said to be the taking of brightly colored, sugar coated cathartic and tonic tablets containing mixtures of cathartics, belladonna and strychnine. It is now known that the presence of strychnine in these mixtures does not enhance or improve cathartic action. Therefore, they are not only dangerous, but also irrational medicines. (Underhill and Koppanyi, 1936).

If discovered early, aliphatic hypnotics, particularly of short or intermediate-acting barbiturates, constitute life-saving measures. I do not believe that hypnotics should be given in doses large enough to suppress the convulsive seizures completely. An overdose of barbiturates may produce a further depression of the respiratory center already damaged by the convulsions.

I doubt if gastric lavage or the administration of activated charcoal is necessary. It is important, however, to insert a retention catheter into the bladder during the barbiturate sleep, because this insures the continuous evacuation of the bladder. If the bladder contains alkaline urine, the strychnine salt changes into the free base which can actually be reabsorbed into the body through the wall of the bladder and repoison the child. This, incidentally, is not only true of strychnine but of other alkaloidal poisons.

Heavy Metals:

Fortunately, we possess in BAL and BAL Intrav. specific chemical antidotes for arsenic and mercury poisoning. The single effective dose of BAL in arsenical intoxication is 2.5 mg. per kg. and in mercury poisoning it should be as high as 5 mg. per kg. They should be given several times daily until the urine is free of arsenic or mercury. Interested physicians may be referred to *The Report of the Council on Pharmacy and Chemistry* which appeared in the J. A. M. A. July 6, 1946.

A theoretical background of the antidotal action of BAL and related compounds is furnished by the realization that the essential feature of heavy metal poisoning is the combination of the metal with the essential sulfhydryl groups in the biochemical system. The action of the antidotes is due to their combination with the metallic poison forming a new stable compound so that the metal is not passed on to the essential sulfhydryl groups. This detoxicant action fortunately also occurs after the poison has been absorbed and united with the essential sulfhydryls because the chemical affinity of BAL for the metal is greater than that of the essential sulfhydryls and displacement occurs.

Phosphorus:

The treatment for phosphorus poisoning requires extreme care, because patients may relapse suddenly after initial improvement.

The chemical antidote while phosphorus is still in the stomach is a 0.5 per cent solution of copper sulfate which prevents the absorption of phosphorus from the gastro-intestinal tract by forming a coat of copper phosphide on the phosphorus. For external phosphorus burns a 1 per cent solution is recommended. For protection of the liver, after absorption has already taken place, large amounts of glucose and calcium salts should be given.

I would not like to close my remarks without congratulating the authors on their excellent report, and the staff of your hospital for their fine record of the astonishingly low mortality rate of 0.8 per cent in 250 cases of poisoning, including practically all the important toxic substances that are encountered in the clinic.

REFERENCES

1. Burdick, D. L., and Rovenstine, E. A.: Picrotoxin in Barbiturate Poisoning, Annals of Int. Med., **22:** 819, 1945.
2. Conference on Poisoning at Duke Hospital, J. of Pediatrics, **32:** 207, 1948.
3. Deichmann, W. E., Ketzmiller, K. V., Winterup, S. C., and Johansmann, R.: Pneumonia, Pneumothorax, and Emphysema Following Ingestion of Kerosene; Annals of Int. Med., **21:** 803, 1944.
4. Gellis, S. S., and Holt, L. E., Jr.: The Treatment of Lye Ingestion by the Salzer Method, Annals of Otology, Rhinology, and Laryngology, **51:** 1086, 1942.
5. Goodman, L., and Gilman, A.: The Pharmacological Basis of Therapeutics, The MacMillan Company, 1943 (6th Ed.).
6. Hazleton, L. W., Krop, S., and Koppanyi, T.: Studies on Barbiturates, Anesthesiology, **2:** 427, 1941.
7. Higgins, J. W.: Rapidly Fatal Result in a Child from Ingestion of Kerosene, The Pennsylvania Medical Journ., **36:** 526, 1933.
8. Koppanyi, T., Dille, J. M., Murphy, W. S., and Krop, S.: J. Am. Pharm. Asso. **28:** 1074, 1934.
9. Koppanyi, T., Linegar, C. R., and Dille, J. M.: J. Pharm. & Exper. Therap., **58:** 199, 1936.
10. Lesser, L. I., Weens, H. S., and McKey, J. D.: Pulmonary Manifestations Following Ingestion of Kerosene, J. Pediat., **23:** 352, 1943.
11. Mitchell, A. G., and Nelson, W. E.: Textbook of Pediatrics, 4th Ed., W. B. Saunders Company, 1947.
12. Murphy, F. J., Zinzi, F. L., and Murphy, L.: Methemoglobinemia, Clin. Proc. of Child. Hosp., **3:** 105, 1947.
13. Morton, H. G.: Atropine Intoxications: Its Manifestations in Infants and Children, J. Pediat., **14:** 755, 1939.
14. Nunn, J. A., and Martin, F. M.: Gasolene and Kerosene Poisoning in Children, J. A. M. A., **103:** 472, 1934.
15. Price, J. P.: Kerosene Poisoning in Children, J. A. M. A., **99:** 214, 1932.
16. Round Table Discussion on Pediatric Emergencies, Pediatrics, **2:** 209, 1948.
17. Scott, E. P.: Pneumonia, Pneumothorax and Emphysema Following Ingestion of Kerosene, J. of Pediat., **25:** 31, 1944.
18. Sollmann, T.: A Manual of Pharmacology, 6th Ed., W. B. Saunders, Co., 1943.
19. Steiner, M. W.: Syndromes of Kerosene Poisoning in Children, Am. J. Dis. of Child., **74:** 32, 1947.
20. Thieves, C. H., and Haley, T. J.: Clinical Toxicology, Lea and Febiger, Philadelphia, 1948.
21. Stevenson, C. S.: Oil of Wintergreen Poisoning, Am. J. M. Sc.: **193:** 772, 1937.
22. Underhill, F. P., and Koppanyi, T.: Toxicology of the Effects of Poisons, 3rd Ed., P. Blakiston's Son and Co., 1936.
23. Vaden, E. B.: Oil of Wintergreen Poisoning, Clin. Proc. of the Child. Hosp., **4:** 185, 1948.
24. Watson, E. H.: Boric Acid, A Dangerous Drug of Little Value, J. A. M. A., **129:** 332, 1945.

JUVENILE RHEUMATOID ARTHRITIS WITH A REPORT OF A CASE IN A 15 MONTH OLD CHILD

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This 15 month old colored female infant was admitted to the Children's Hospital on September 11, 1948 because of fever and painful, swollen ankles and wrists.

The child had been well until approximately three weeks prior to admission. At that time her right ankle and both wrists became tender and swollen. At the same time she developed a slight elevation of temperature. The patient, who had been walking normally up until the onset of her present illness, then refused to support her weight on her lower extremities. She has not walked since the onset of her symptoms. The child was taken to a local hospital and admitted for treatment and study. After a period of three weeks, she was discharged as unimproved with a diagnosis of acute sinusitis. The day after her discharge, she was seen in the outpatient department of this hospital and admitted with essentially the same complaints she presented when she first became ill.

The past history revealed the patient to be allergic to orange juice. However, she had always received adequate amounts of vitamin C in the form of ascorbic acid tablets, and vitamin D in the form of oleum percomorphum. She had never been out of the District of Columbia and her drinking water came from the local city supply. The remaining history failed to elicit any pertinent data.

On admission the temperature was 103.4 F., respirations 56 and pulse rate of 160. Examination revealed a well developed, well nourished colored female child who appeared acutely ill, quite pale, and very irritable. A moderate amount of dyspnea was present. There was a mild, generalized lymphadenopathy. An urticarial rash was noted over the chest and back. During inspiration, mild substernal and intercostal retractions were seen. Auscultation revealed the presence of harsh breath sounds and expiratory wheezes throughout both lung fields. The cardiac examination was negative. The liver and spleen were not palpable. On examination of the extremities a doughy swelling was noted over the metacarpals and wrists, and over the dorsum of both feet. There was no local heat or redness but motion of any of the involved joints produced pain. There was a definite limitation of flexion of the right wrist.

Therapy at this time consisted of 0.3 cc. of adrenalin subcutaneously, elixir of benedryl, one dram three times a day and penicillin, 30,000 units every 3 hours intramuscularly. On this regime the urticaria and respiratory symptoms abated. However, the patient remained irritable, con-

tinued to run a septic type of temperature, and the edema of the wrists and feet was unchanged.

An admission x-ray of the chest was interpreted as being negative. The day following admission, September 12, 1948, a sickling preparation showed 20–30% of the erythrocytes to be sickled; the hemoglobin was 5.7 grams and the red blood cells numbered 2.6 million. A blood transfusion of 200 cc. of whole blood was administered. Although the patient's color improved and repeated hemograms showed the blood picture to be maintained at a near normal level, the overall symptomatology persisted.

Because urinalysis on admission revealed 10 mgms. of albumin and innumerable white blood cells, the penicillin was discontinued and the patient started on sulfadiazine. Subsequent urinalyses failed to reveal any abnormalities and the sulfadiazine was stopped.

Other laboratory data included the following findings:

1. Stool and urine cultures were negative.
2. Repeated febrile agglutinations were negative.
3. Blood cultures taken when temperature spikes were at their peaks were repeatedly negative.
4. A spinal tap, done three days after admission because the patient developed stiffness of the neck, was normal.
5. An electrocardiogram was within normal limits.
6. The sedimentation rate ranged between 23 mm. per hour and 47 mm. per hour.
7. The tuberculin (O. T.) and Wassermann tests were negative.
8. An x-ray of the wrists and ankles revealed "soft tissue swelling about the joints with rarified areas in the metaphyses just proximal to the presumptive zone of calcification. The significance of these transverse lines of decreased density may be associated with early scurvy or possibly very early evidence of rheumatoid arthritis."

For the first week the patient continued to run a septic type of temperature course ranging between 98.6 F. and 104 F. Her appetite was poor and she continued to be quite irritable. On the seventh hospital day, she was started on aspirin, 2½ grains every 4 hours. This produced a dramatic change. The temperature course flattened out and she became afebrile. Her appetite improved and she began to gain weight. Fusiform swelling of the digits, praticularly of the thumbs was noted to develop. However, the pain seemed to be relieved and the patient appeared much more comfortable. The aspirin was continued for 12 days and then stopped. On October 4, 1948, twenty-four days after admission the patient was discharged to the physiotherapy clinic for follow-up. At no time during the hospital stay did the spleen become palpable; subcutaneous nodules were searched for but never noted; and although myocarditis and pericarditis were carefully watched for, they failed to develop.

DISCUSSION

At the Children's Hospital during the past 12 years, a definite diagnosis of rheumatoid arthritis was made in 16 cases. Since the number of hospital admissions during this same period numbered approximately 78,000, the incidence in this series is 0.02%. This indicates that rheumatoid arthritis is a rather infrequent disease in childhood; 10 cases occured in females, while 6 were in males, a ratio of almost 2:1 in favor of the former. Cardiac complications developed in 2 of the children. One, a 4 year old white male, developed a pericardial effusion and a myocarditis; the other, a 7½ year old white female showed only a myocarditis. Both cases recovered without incident. On only 3 occasions (including the case reported) was the diagnosis made in children under 2 years of age, a 12½% incidence in the cases reported. The others ranged in years between the ages of 3 and 13, an average of 8 years. Four of the children were colored, while the remaining twelve were white. Since the white admissions at this hospital outnumber the colored 3:1, no racial preponderance can be shown to exist.

There are not many reports in the literature of rheumatoid arthritis in children under 2 years of age. Burdick[1] in 1946 reported 2 cases, one in a 21 months old colored female, the other a 14½ month old white male, both from this hospital. Maggi[2] in 1945 reported a case in a 3½ year old white male, the onset of the illness occurring at the age of 2 years. As far as could be determined only 2 series of juvenile rheumatoid arthritis have been reported. Angevine[3] in 1942 recorded 6 cases from the Alfred I. duPont Institute. Five of these cases occurred in females, while only one was a male. Coss and Boots[4] have provided the largest series of rheumatoid arthritis in children. In 1946, they reported a series of 56 cases diagnosed at Colombia Presbyterian Center since 1928. Their criteria for diagnosis follows:

1. Periarticular swellings
2. Contractures
3. Loss of motion
4. Joint effusions
5. Characteristic x-ray changes
6. Subcutaneous nodules
7. Enlarged lymphatic glands
8. Splenomegaly and hepatomegaly
9. Persistence of these changes over a period of years.

The characteristic x-ray changes include:

1. Decalcification
2. Bone destruction
3. Joint space narrowing

4. Soft tissue changes
5. Failure of maturity.

The salient features of this large series is given:

1. A ratio of 5 females to one male.
2. 32% had a history of possible related conditions, viz., rheumatic fever, chorea, rheumatoid arthritis, recurrent arthralgia, allergic symptoms, respiratory disease and heart disease.
3. 30% had splenomegaly; 23% had hepatomegaly.
4. 12.5% had evidence of myocardial damage on electrocardiography.
5. There were 2 fatalities, one with adhesive pericarditis.
6. 80% had a tendency toward moderate anemia and 54% had a leukocytosis between 15–30,000.
7. One case developed amyloidosis.

There is no known cure for rheumatoid arthritis but there are many remedies. Rittwagen[5] reported a case successfully treated with prostigmine when all other measures had failed. The prostigmine was given both orally and intramuscularly and with each dose, 1/300 grain of atropine was given. The intramuscular injections were given as prostigmine methyl sulfate, one ampoule of 1:2000 solution, first 3 times daily, then twice daily, then once daily, over a period of 2 months. The oral dose of prostigmine bromide was 15 mgms. once daily for the first 2 months. Then when the intramuscular therapy was stopped, the oral dose was given 3 times daily for approximately two months, reduced to 2 times daily for two more months, and then one daily dosage for approximately four months.

The salicylates have their advocates[6] and it is interesting to note that our patient improved after the initiation of salicylate therapy. Ashmun[7] recommends the use of streptococcus immugens, and in addition the use of undulant fever vaccine in those cases with a positive skin or agglutination test for undulant fever. He also recommends the removal of foci of infection; high vitamin intake; and blood transfusions. On the other hand, Strong et al.[8] recommend the daily use of large doses of vitamin D concentrate and report a case in which it was efficacious. Gold therapy has its advocates[4] but this form of treatment is dangerous and should only be utilized by competent and experienced adminstrators.

It is readily seen that rheumatoid arthritis has a host of remedies. It is difficult to evaluate any of these therapeutic measures since it is a well known fact that the disease is characterized by spontaneous periods of remission. However, one measure has the author's most vigorous recommendation. This is the use of physiotherapy early in the disease and during periods of remission. Roden[9] of the British Isles, where rheumatoid arthritis is more prevalent than in this country, has published an excel-

lent paper on what the physiotherapeutic regime should comprise. These include:

1. Thermal agents, both local and general.
2. Massage.
3. Exercise and rest.
4. Hydrotherapy, contrast baths, and wet packs.
5. Iontophoresis.

In general it may be said that juvenile rheumatoid arthritis is not a hopeless disease process. Although many failures have been reported, the prognosis is good. Early physiotherapeutic measures will prevent many of the contracture deformities. Many of these contractures lend themselves to orthopedic correction. In the case presented, the prognosis for ultimate cure is felt to be excellent.

SUMMARY

1. A case of juvenile rheumatoid arthritis occurring in a 15 month old child is reported.

2. A report of 16 cases of this disease occurring over a span of 12 years at the Children's Hospital is presented.

3. A review of the literature, with particular stress on treatment and management of rheumatoid arthritis, has been made.

REFERENCES

1. Burdick, W. F.: Still's Disease (Atrophic Arthritis, Atrophic Rheumatoid Arthritis or Infectious Rheumatoid Arthritis), Southern Medical Journal, **39:** 626 (August) 1946.
2. Maggi, R.: Still's Disease: Report of a Case, La prensa medica argentina, **32:** 976 (May 25) 1945.
3. Angevine, D. M.: Rheumatoid Arthritis in Children, Clinics, **1:** 582 (October) 1942.
4. Coss, J. A., Jr., and Boots, R. H.: Juvenile Rheumatoid Arthritis. A Study of Fifty-Six Cases with a Note on Skeletal Changes, J. of Ped., **29:** 143 (August) 1946.
5. Rittwagen, M.: Still's Disease Successfully Treated with Prostigmine. Report of a Case, Archives of Pediatrics, **63:** 630 (December) 1946.
6. Lawson, R. B.: Salicylate Therapy for Rheumatic Fever and Atrophic Arthritis (Still's Disease) in Children, North Carolina Med. Journ. **5:** 477 (October) 1944.
7. Ashmun, R. H.: Still's Disease, Ohio State Med. Journ., **41:** 324 (April) 1945.
8. Strong, R. A. et al.: Still's Disease, New Orleans Med. and Surg. Journ., **92:** 466 (February) 1940.
9. Roden, D.: Treatment of Rheumatoid Arthritis in Children, British Med. Journ., **1:** 102 (January 24) 1942

A CASE OF ATYPICAL MEASLES

Case Report No. 142

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R. S., an 18 month old white boy, was admitted to the Children's Hospital on June 27, 1947 because of fever and a rash covering the entire body. He was the product of a full term, normal, spontaneous delivery, without postpartum difficulties. The birth weight was 3675 gms. The dietary history was adequate. The infant was vaccinated against tetanus, diphtheria and pertussis at the age of 8 months and against small pox at the age of 12 months. A tonsillectomy was performed at the age of 16 months.

The patient was apparently well until 4 days prior to admission when vomiting and a slight cough were noted. On the following day a fever of 102 degrees F. and a rash on the arms and legs developed. The temperature became normal the next day and remained so until the night before admission when it rose to 101 degrees F. At the same time the rash spread over the entire body and became more prominent. There was no associated cough, coryza or lachrymation, nor was there a history of exposure to measles, contact with ticks or medication. No personal or familial allergies were known. There was no history of serum or other drug therapy prior to contraction of the disease.

The physical examination on admission revealed a well developed, well nourished boy appearing not too acutely ill. The temperature was 101.8 degrees F.; a maculopapular rash was present over the entire body including the palms and soles, but more marked on the trunk and extremities with prominence in the body creases, particularly the groin. Other than a slightly injected pharynx the remainder of the examination was negative.

Laboratory examination performed on the day of admission revealed a slight leucopenia of 4,600 with an increased number of lymphocytes (62 percent). Febrile agglutinations and a blood culture were negative. On the following morning the child's temperature returned to normal only to rise again to 101 degrees in the evening. Elixir of benadryl given repeatedly failed to alter the appearance of the rash.

On the second hospital day the temperature dropped to 100 degrees F., the eyelids were slightly edematous, lachrymation was prominent, and the nasal mucosae injected. A new maculo-papular rash became evident over the face and examination of the mouth disclosed injection of the buccal mucosa with many Koplik's spots. The rash persisted during the next five days.

DISCUSSION

The etiology of the prominent rash covering the arms and legs during the first two days of hospitalization was a subject of speculation until the eruption of Koplik's spots at the end of the second hospital day. Rocky Mountain spotted fever was considered but the lack of history in regard to contact with ticks, afebrile periods and negative agglutination test (with proteus OX_{19} in dilution of 1:20) seemed to rule this out. The lack of an allergic history in the infant or his family and failure of the rash to respond to an anti-histaminic agent (benadryl) discounted the possibility of an allergic eruption preceding measles.

Measles associated with other infectious diseases such as rubella or roseola infantum should be regarded. If the primary infection were assumed to be rubella it would seem noteworthy to mention that the apparent double infection was an accidental one and there was no relation existing between the two diseases. The infrequency of rubella in this age group, the initial appearance of the rash over the extremities and particularly the lack of enlargement of posterior cervical, sub-occipital and retro-auricular lymph nodes were the factors against such a diagnosis. The occurrence of measles with roseola infantum has not to my knowledge been previously reported; however, a diagnosis of roseola does not appear likely for in that condition the rash is not accompanied by a fever although it is preceded by a high fever of three to four days duration and the rash itself lasts only a few hours to a day or two. Such was not the case herein reported.

Among the varities of measles, hemorrhagic or black measles is not too frequently encountered and may be confused with Rocky Mountain spotted fever. It is generally seen in epidemics and the high mortality rate in this form is the result of the invasion by hemolytic streptococci. In the differential diagnosis it is well to note that the clinical course of measles may be further modified by the administration of convalescent serum or immune serum globulin (human gamma globulin) given during the early stage of incubation.

Several cases of atypical measles have appeared in the literature during the past 24 years which are deserving of mention. Papp[4] reported cases of inapparent measles, in which he says "it has been shown by the presence of antitoxin in the blood that there has been an inapparent previous infection and there are certain facts which also seem to show the existence of inapparent measles and it is probable that among the rare adults who are immune to measles, most of them had had an inapparent infection." LoPresti[3] reported two cases of measles without eruption and a case without fever. Six cases of measles with prolonged invasion periods have been reported by Blechmann[1] in which the febrile stage lasted from 9 to 20 days instead of the usual 4 to 7 days. In two of these six cases, the incubation

period was reduced to 4 instead of the usual 10 days. Selby[6] also reported two cases of measles with prolonged invasion periods of 9 and 11 days.

SUMMARY

A case of atypical measles is reported in which an unusual onset was noted, namely the appearance of the rash initially on the extremities without other signs of measles. Also of interest is the appearance of Koplik's spots after spread of the rash over the entire body and six days after the onset of rash over the extremities. The rash persisted for 12 days in contrast to the usual period of three to seven days.

REFERENCES

1. Blechmann, G.: Abnormal Measles with Prolonged Invasion, Difficulty of Diagnosis. Bulletins et memoires de la societe de medicine de Paris, p. 522 (October 24) 1924.
2. Bradford, William: Rubella (German Measles), Ch. 12, Vol. II, Brennemann's Practice of Pediatrics. W. F. Prior Co. Inc., 1948.
3. LoPresti, S. F.: Measles without Eruption and Measles without Fever. Archives de Medicine des enfants, **32:** 336 (June) 1929.
4. Papp, K.: Inapparent Infection in Measles. Comptes rendusdes seances de la societe de biologie., **123:** 1070, 1936.
5. Selby, Robert: Delayed Rash in Measles. Clinical memoranda. The British Medical Journal, Feb. 8, 1936.
6. Strong, Robert A.: Measles. Ch. II, Vol. II, Brennemanns Practice of Pediatrics. W. F. Prior Co. Inc., 1948.
7. Wesselhoeft, Conrad: Rubella (German Measles) Vol. 236, No. 25, 1947. The New Eng. J. of Med.
8. Zahorsky, John: Roseola Infantum. Ch. 21, Vol. II, Brennemann's Practice of Pediatrics. W. F. Prior Co. Inc., 1948.

CLINICO-PATHOLOGICAL CONFERENCE

Directed by: E. Clarence Rice, M.D.
Assisted by: Edwin Vaden, M.D.
D. Joseph Judge, M.D.
By Invitation: Frederic G. Burke M.D.

Edwin Vaden, M.D. J. J. 30-4413

This eight year old white male entered Children's Hospital on September 6th with a history of having been sick for three days. On the day of onset he refused his breakfast and later complained of headache and stomach ache. The following day he appeared very feverish and he was given castor oil, which he promptly vomited. The third day of his illness, the day of admission, the patient was feverish and drowsy and still complained of his headache and stomach ache. He was seen by his physician early in the day and again that night. At the time of the second visit of the doctor the patient had developed right-sided pain and his general condition was worse. He was referred to the hospital with the diagnosis of appendicitis.

The admission physical examination disclosed an acutely ill patient with a temperature of 103.2 degrees F., pulse rate of 110, and a respiratory rate of 25. His blood pressure was 90 systolic over 50 diastolic. His nutrition was very poor (weight, 40 pounds) and a slight rachitic rosary was noted. The skin was hot and dry and the tongue was heavily coated. The pupils were equal and regular. There was slight pharyngeal injection with moderate enlargement of the cervical nodes. The lungs were clear. The heart rate was very rapid but the sounds were of good quality. There was generalized abdominal tenderness, more pronounced on the right. There was also some muscle rigidity of the right side. The leucocyte count was 11,900 with a marked shift to the left. A urinalysis was normal. The chest x-ray was interpreted as being normal.

The only past illness was measles. The family history was non-contributory.

Immediately after admission an appendectomy was performed. No pathological changes were noted in the appendix or in the peritoneal cavity.

The second hospital day there was slight rigidity of the neck and the patient complained of pain upon flexion of the head on the chest. A lumbar puncture was performed. The spinal fluid findings were normal.

The next day the patient appeared more toxic and the conjunctivae were congested. Later in the day a discrete macular purplish-red rash was noted on the chest. It spread to the extremities, flexor and extensor surfaces, and faded upon pressure. With the onset of the rash the conjunc-

tivae became more congested and chemosis appeared. The patient became stuporous and a second spinal tap was done because of the stupor and persistent meningismus. Again the spinal fluid was normal.

On the 5th hospital day the eruption became more confluent. The examiner stated that no Koplik spots were present. The patient appeared better early in the day, but his temperature rose to 106.5 degrees F. that afternoon.

The boy received whole blood transfusions on the fifth and sixth hospital days. He appeared to be improving but became suddenly worse and expired on the 7th day.

Additional laboratory data: Daily leucocyte counts were done and there was a progressive increase in the leucocytosis from the admission count of 11,900 to 27,000 reported on the day before his death. There was a marked shift to the left with 85 to 95 percent neutrophiles and many band forms. A second urinalysis was normal. A blood culture on the second hospital day was reported as no growth. A Weil-Felix test was done on the same day with no agglutination.

The temperature fluctuated between 103.2 and 107 degrees F. with daily spikes occurring during the afternoon or early evening. The pulse remained elevated between 110 and 170. Therapy was principally symptomatic.

DISCUSSION

Frederic G. Burke, M.D.: This eight year old child was admitted to the hospital in a critically ill stage in the month of September with the principle complaints referable to the gastro-intestinal tract. The presence of a high fever with gastro-intestinal manifestations of vomiting and abdominal pain may be the forerunner of a large number of illnesses. Any of the common contagious diseases may have such an onset; any of the common febrile antigenic bacteria may clinically manifest their presence in the prodromal stage by these symptoms. I am sure that within the past 8 years I have seen all of these diseases turn out to be the final diagnosis when the initial complaints were seriously considered in the differential diagnosis of acute appendicitis. In many instances children admitted with such a picture during this period of time have had their appendix removed and later shown evidence of pneumonia, chickenpox, scarlet fever, measles, German measles, whooping cough, typhoid fever, paratyphoid fever, tularemia, Rocky Mountain spotted fever, brucellosis, acute glomerulonephritis, sickle cell anemia, acute rheumatic fever, etc. The negative chest x-ray at the time of admission occasions no surprise since it is well known that clinical evidence of pneumonia will precede roentgenologic evidence by at least 24 hours and a negative chest x-ray has been observed in children with

pneumonitis whose principal symptoms were referable to the gastro-intestinal tract. In some instances appendectomies have been performed on the basis of a negative chest x-ray despite clinical evidence of a pneumonic process when the chest x-ray was reported as being negative and referred pain to the abdomen presented the picture of acute inflammation of the appendix. Nearly all of the above named conditions may be accompanied by an exanthem.

On the second hospital day there were signs of meningeal irritation so as to occasion a lumbar puncture and even when this was repeated the spinal fluid on both occasions was reported as being normal. It must be pointed out that evidence of meningeal irritation such as nuchal rigidity and spasm of the erecti-spini muscles are not infrequently noted in practically all of the above mentioned diseases and it is particularly prominent in measles, typhoid fever and Rocky Mountain spotted fever. The fact that the spinal fluid was normal does not militate against any of these diagnoses although 1 percent of the cases of measles will have a pleocytosis and it is not unusual in typhoid and Rocky Mountain spotted fever to find slightly elevated protein content and a few cells. The history states that the only past illness of this patient had been measles but this must be questioned. While second attacks of measles do occur they are relatively uncommon. The protocol does not give any information as to details about the past history of measles.

I think a good deal of importance must be placed on the description of the rash which is described as a discrete maculo-papular red rash which was first noted on the chest spreading to the extremities, a centrifugal type of rash which faded on pressure accompanied by marked conjunctivitis and chemosis. This description would best fit the rash associated with measles but because of the negative spinal fluid, the previous history of having had measles, because of the absence of Koplik's spots and the presence of marked leucocytosis one must veer away from this as the diagnosis but as Dr. Molari used to quote frequently to us when making an uncertain diagnosis "One must always leave oneself open a little door behind." I will therefore not exclude measles at this time.

Let us next consider the possibility of typhoid fever. The gastro-intestinal manifestations accompanied by a high fever, hypotonia, a hot dry tongue, some moderate generalized lymphadenopathy with abdominal tenderness would suggest that it be included in the differential diagnosis. Leucocytosis and elevated blood count would rule against but not rule out typhoid fever and the rash usually associated with this disease is most frequently so faint as to elicit questioning glances on the faces of medical students when the "rose spots" of typhoid are pointed out. This rash would appear to be far too definite. The negative blood culture and Widal

test done on the second day after admission would have no particular significance since these might well be expected to be negative during the first week.

I would like to ask Dr. Rice where this child lived and something about the water and milk supply consumed by the family.

Dr. Rice: I think that is a perfectly legitimate question. The family of this child lived in a rural area in Arlington county, Virginia about 10 miles from the city of Washington. We have no information on the chart as to the reliability of the water and milk supply but it is quite possible that the child could have had access to contaminated water in that area.

Dr. Burke: Typhus fever and Rocky Mountain spotted fever must be seriously considered. The prodromal symptomatology would fit well with this impression. A disturbing influence is the fact that this child was admitted on the 6th of September, a period when in this area we seldom see Rocky Mountain spotted fever, the majority of cases occurring early in the spring and summer. However, occasional cases have been reported in the east as late as in the middle of September. Abdominal pain associated with liver tenderness most infrequently simulating appendicitis is a common presenting symptom in Rocky Mountain spotted fever, typhus and typhoid fever. The hemogram would support this impression; while a leukopenia is not infrequently seen in the initial phases of these rickettsial infections, it is more common to develop a leukocytosis such as this child showed including a marked shift to the left with many young forms and marked granulocytosis. The febrile course with temperature ranges up to 107° is more in keeping with the impression of rickettsial disease than with measles. Conjunctivitis and chemosis are not uncommon. Severe prostration, mental confusion, restlessness, hyperesthesia of the skin and muscles are not infrequently noted as early signs. Because of the decreased intake of food and fluids, dehydration usually develops rapidly and while there is no mention of edema the indications for the blood transfusions given on the fifth and sixth days are not mentioned. Presumably he showed a considerable degree of pallor and possibly some edema to indicate this therapy.

A disturbing point is the fact that the rash appeared on the chest and then centrifugally spread to the extremities. The rash in Rocky Mountain spotted fever usually appears around the ankles and wrists initially and spreads in a centripetal fashion to include practically the entire skin, the rash being the visible evidence of a specific lesion occurring in the blood vessels as the organisms migrate peripheralwards during the septic phase. The rash in typhoid fever first appears on the abdomen and usually does not become purpuric. Typhus, which is practically unknown in the city of Washington, may closely resemble spotted fever and characteristically

the rash usually develops on the chest, abdomen, and back but in the endemic flea borne variety that is seen in this country it is much less pronounced, does not become hemorrhagic and is frequently fleeting in contrast to the rash described in this protocol. I have seen the rash of spotted fever develop on the chest and spread to the extremities and although this is usually not the case it can occasionally occur. The fact that the rash blanches on pressure serves only to confuse it with measles since this also occurs in rickettsial disease.

Urinary infections with azotemia are ruled out by a normal urinalysis and lack of supportive findings, as is acute glomerulonephritis. The patient's course and description of the rash rule out rheumatic fever, sickle cell anemia and the other exanthems previously mentioned.

One disease that I have not mentioned is meningococcemia which I must exclude simply on the basis of lack of evidence. I find insufficient evidence in the protocol to rule this in or out since normal spinal fluid findings are not unusual during the first 24 hours or so after the onset of the disease. The best single piece of evidence against this diagnosis is the note that the patient had been sick for 3 days before admission to the hospital. Rat bite fever, Haverhill fever, Weil's disease and brucellosis are similarly excluded on the basis of lack of evidence.

I must therefore select as my diagnosis Rocky Mountain spotted fever eliminating endemic flea borne typhus fever on the basis of its rarity. I think that I can eliminate measles on the basis of the previous history, the marked febrile course, the lack of spinal fluid findings, the absence of Koplik's spots, the presence of marked leukocytosis, the absence of significant lung findings and the absence of a history of exposure. There is no indication of it in the protocol but if this child died of measles or Rocky Mountain spotted fever he probably had a complicating hemorrhagic pneumonitis and myocarditis. Typhoid fever on the basis of the information offered is eliminated by the description of the rash, the normal pulse, the lack of splenic tenderness or palpable spleen and the leucocytosis.

In contemplating the cause of death in this case it should be pointed out that before the advent of aureomycin and PABA the mortality rate in Rocky Mountain spotted fever in patients under 40 was 12 percent and in this hospital in 30 cases between 1932–1945 the mortality rate was 10 percent. Between 1946 and 1947 there were 17 cases of spotted fever which were treated with PABA and there were no deaths in this group. During the past year there were 13 patients treated with aureomycin with no mortality and a dramatic diminution in the course and severity of the disease in all cases.[1]

To the best of my recollection I have not heard of or seen a case of typhus fever in the city of Washington or its environs. Certainly on the basis of

the rash and on the lack of corroborative evidence one must select typhus fever as the initial impression but on a percentage basis it can be eliminated in this particular case. I therefore believe this child had Rocky Mountain spotted fever.

PATHOLOGICAL DISCUSSION

E. Clarence Rice, M.D.: The diagnosis of Rocky Mountain spotted fever is correct; in addition there was a complicating septicemia due to the hemolytic streptococcus.

The patient, an emaciated and rachitic boy, apparently of the stated age, eight years, had a fading copper colored macular rash with petechial hemorrhages, the latter also being noted in the sclera and conjunctivae. The pleural cavities each contained approximately 100 ml. of turbid fluid and the peritoneal cavity contained several hundred milliliters of thin purulent fluid, there being a slight fibrinous exudate attached to the mesentery and omentum. No adhesions were noted. The lungs were edematous and congested. The heart muscle was flabby. The liver was moderately enlarged, congested and showed evidence of fatty metamorphosis. The spleen was larger than normal and on section the pulp was soft and deep red in color. The kidneys were congested and edematous. The lymph nodes, mediastinal and mesenteric, were enlarged and congested. The meningeal vessels were congested and the brain appeared swollen. The vessels of the brain were distended with blood.

Microscopic examination of the lungs revealed bronchopneumonia, small hemorrhages, congestion and edema. The heart muscle showed neutrophilic polymorphonuclear and mononuclear infiltration between the fibers with some evidence of necrosis. The liver, in addition to fatty metamorphosis, was the site of mononuclear and polymorphonuclear leukocytic infiltration with small points of focal necrosis. The kidneys, in addition to congestion, revealed an early acute glomerulonephritis with endothelial hyperplasia in the glomeruli and vacuolization of the tubular epithelium. The skin was the site of hemorrhages about the capillaries and some of the smaller vessels were thrombosed. The brain likewise showed perivascular hemorrhages, capillary thrombi and perivascular cuffing with round cells.

The distinctive histopathologic finding was the endothelial proliferation of the smaller blood vessels and capillaries with involvement of the walls of the arterioles, mononuclear cells and macrophages forming an infiltrate about them. Thrombi were not infrequent. Rickettsiae were identified in the endothelial cells in sections prepared at the National Institute of Health.

Cultures of the heart's blood, spleen, pleural and peritoneal exudates grew *Streptococcus hemolyticus*. The Weil-Felix reaction done on heart's blood gave a positive reaction in dilution of 1:1,280 with Proteus OX_{19}.

Pathologic diagnosis:

Bronchopneumonia, bilateral
Acute myocarditis
Early empyema, bilateral
Peritonitis
Acute diffuse glomerulonephritis
Congestion of thoracic and abdominal viscera
Cerebral and meningeal congestion
Generalized perivascular hemorrhages and capillary thrombi, with invasion of endothelium with rickettsiae
Postoperative appendectomy

On the basis of the bacteriological and histopathological findings the diagnosis of Rocky Mountain spotted fever with complicating hemolytic streptococcus septicemia was made.

The illness of this patient serves to illustrate the difficulty which may be encountered in making the diagnosis of Rocky Mountain spotted fever, as evidenced by the abdominal pain which was sufficient to warrant operative intervention and the later complicating factor, a streptococcus septicemia.

This case also brings out the progress which has been made in the diagnosis and treatment of rickettsial diseases during a relatively short time. During the eighteen years which have elapsed since this patient's death it has been possible to separate typhus fever from Rocky Mountain spotted fever by complement fixation test and an effective and specific chemo- and antibiotic therapy has been evolved which gives promise of radically reducing the mortality for the group of rickettsial diseases.

REFERENCE

1. Ross, S., Schoenbach, E. B., Burke, F. G., Bryer, M. S., Rice, E. C., and Washington, J. A.: Aureomycin Therapy of Rocky Mountain Spotted Fever. J. A. M. A., **138:** 1213, Dec. 25, 1948.

NOTES

Joseph Michael LoPresti, M.D. (*Juvenile Rheumatoid Arthritis with a Report of a Case in a 15 Month Old Child*) b. March 25, 1919, Brooklyn, N. Y. St. Peter's College, Jersey City, N. J. M.D. Georgetown Med. School, Washington, D. C. Medical Corps, AUS April 1946 to May 1948. Residency 2 years Children's Hospital, Washington, D. C. Dr. LoPresti plans to practice pediatrics.

Hassan Ahari, M.D. (*A Case of Atypical Measles*) b. August 2, 1922, Tabriz, Iran. Pre-Med. and Medical School of Teheran. Rotating internship at University Hospitals of Teheran; Postgraduate course in Pediatrics at Harvard Medical School. Resident at Children's Hospital, Washington, D. C.

MEDICINE MARCHES BACKWARDS

Pathological Pathology Conference

Washington City Garage

Snerd X. Fannavessey, D.M. Mechanics Local No. 10

A 1948 Buick Super sedan, robins-egg blue, was admitted to the Washington City Garage in complete coma. History was obtained from the well-to-do cement maker, and revealed the following facts:

On the day before admission the auto had been wheezing and coughing when subjected to ordinary acceleration. This was productive of greasy black exhaust smoke but no hemoptysis had been observed. There was no dependent edema of the tires at this time or any previous time. There had been no paroxysmal nocturnal sputtering, no wheezing on level terrain, no hood pain or pain radiating down the left or right front fenders. Spluttering never appeared while the engine was idling and starting was always easily accomplished. Until the day before admission the auto had been in perfect health. Ethyl gasoline was always used and there was no intolerance to Pennsylvania motor oil.

Physical examination revealed the described automobile in complete coma. The temperature was 72 degrees Fahrenheit, the oil pressure was not obtainable. Revolutions were zero, no edema of the tires was noted, and there were no murmurs audible. All reflexes were absent. Small, 2 cm. punched-out areas were found behind the rear bumper and on the posterior aspect of the rear fenders, most pronounced on the right, but also present on the left.

Exhaust pipe digital examination revealed good tone, spherical bore of normal caliber, and a small amount of black soot present on the examining finger.

Gasoline was present to the amount of 11.50684 gallons (at 74 degrees F.). There was a normal explosive index by the match test and no sediment. Cell count was zero.

Examination of the engine was negative. Oil filter not palpable. There was no bruit over the intake manifold, starting motor functioned normally, and good spark, by the finger test, was demonstrated. Percussion of the transmission revealed a suspicious area of dullness over the infero-posterior aspect measuring 3 cm. in diameter and roughly spherical in shape. The muffler was not dilated; no localized weaknesses or necrotic areas were observed.

On the second garage day an operation was performed.

DISCUSSION

Mechanic Loftwell F. Bonk, Assistant in Carburetion, Washington C. G.: Well, uh, what gets me about dis case is, uh, the punched-out areas on dose rear fendahs. What do dey mean? Nuttin! Dat's right, nutting! Dere weren't any mention of de tires; what about dem? We don't know. Dat dullness over da transmission might be a red herring so I'll t'row it out. Dat cell count of da gasoline might not be da real t'ing so I'll t'row it out too. Cripes, dis is tough. Tell ya what I t'ink dis is; a couple cases in Yurrup of paroxysmal alternating stenosis of the anterior chamber of da fule pump been reported in da Journal of Twisted Crankshafts (**114**: 95-112, June 1919) so I'll bet on dat. Okay? It's gotta be! Nuttin' else would cause dis!

MECHANIC'S OPERATION REPORT

Rodwell F. Gagblood, Chief Mechanic, Washington C. G.: Uh, well, we tore dis baby down and found a lotta t'ings. A lotta t'ings. Carbon on da plugs, burned valves, sticky rings, boined-out bearings, and a spot of necrosis of the inferior part of Bearing Right 4. Nuttin' specific, though don't get me wrong. Da fuel pump was okay, Bonk. Get me? #/%@# Clean as a whistle! Dat puts you in left field! We couldn't find NUTTIN' dat would cause dis! NOBODY coulda found it! We put her back together again and she runs fine! I take out da gas line and what do I find? DIRT! Dis has to be differentiated from dat Schimmelschwein Syndrome dat you were bettin' on, Bonk. Da difference is dat in dese cases ya don't get gas outta da line where it enters da pump. Always check da line!

Mechanic Bonk: Say Rod, what did da tires show on microscopic section?

Mechanic Gagblood: NUTTIN'!!!!!!